

DOCUMENT RESUME

ED 171 953

CE 021 499

AUTHOR Abramson, Theodore
TITLE Cost Benefit and Job Analyses in Vocational Education Evaluation.
INSTITUTION City Univ. of New York, N.Y. Inst. for Research and Development in Occupational Education.
PUB DATE Apr 79
NOTE 23p.; Paper presented at the Annual Meeting of the American Education Research Association (San Francisco, California, April, 1979) ; Best copy available
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Accountability; *Cost Effectiveness; Curriculum Planning; Efficiency; *Job Analysis; Job Skills; Postsecondary Education; Program Content; *Program Effectiveness; *Program Evaluation; Program Improvement; Program Planning; Secondary Education; Task Analysis; Vocational Education
IDENTIFIERS Comprehensive Occupational Data Analysis Programs

ABSTRACT

Two major areas of concern to vocational education are cost benefit and job and task analysis. In recent years vocational education has broadened its outlook in terms of general human development, but the historical context of vocational education and concerns for accountability require evaluation of vocational education programs to consider cost factors and the relationship of programs to the world of work. The computer capabilities of the Comprehensive Occupational Data Analysis Program (CODAP) system and similar systems, such as the Vocational and Technical Education Consortium of the States (VTECS) that are in the process of being developed, have rather direct implications for planning and evaluation. Task analysis may serve as a basis for curriculum planning and can lead to statements of behavioral objectives and criterion-referenced measures that assess student learning. A CODAP-type system can help occupational educators derive listings of tasks that are required of employees at different levels. This system can be useful in evaluating program outcomes and estimates of the cost and benefits of these outcomes. Two concepts that have been useful in arriving at estimates in cost effectiveness studies are the staging concept and the seriousness index. (A sample task analysis is appended.) (LRA)

 * Reproductions supplied by EDRS are the best that can be made *
 * from the original document. *

ED171953

BEST COPY AVAILABLE

Cost Benefit and Job Analyses In Vocational Education Evaluation

Theodore Abramson

Institute for Research and Development
in Occupational Education
Center for Advanced Study in Education
Graduate School and University Center
City University of New York
33 West 42 Street
New York, New York 10036

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

"PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY

T. Abramson

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

Paper presented at the Symposium: Vocational Education Evaluation:
Current Issues and Methods for Educational Evaluation. American
Education Research Association annual meeting, San Francisco,
April 1979.

Session 10.26

CE 021 499

Cost Benefit and Job Analyses
In Vocational Education Evaluation

Theodore Abramson

Queens College and Graduate School
City University of New York

Vocational Education is a major component of our educational systems at the secondary and post-secondary school level. Most people view vocational education in a different perspective than the more traditional curriculum and, in fact, have different expectations for the graduates of vocational and occupational education programs than they do for the students who obtain a more general or academic diploma. Different expectations for program outcomes have obvious implications for instructional and program processes and program products. These differences in perspectives can be understood when one views the evolution of vocational education from a historical perspective.

Gallinelli (1979), presents an overview of the historical, sociological, philosophical, and economic bases that traces the development of our current view of vocational education and the expectations for these programs as embodied in our current legislative mandates. As might be expected, the general view is a rather narrow one in terms of the expected outcomes for vocational education graduates. An examination of the legislation up to 1963 indicates that monies were allocated for specific training of people to fit within certain narrowly defined, limited occupational groups that were perceived as required for the national interest.

Obviously, shifts in perceived national interest lead to changes in priorities for vocational education funding. Usually, these shifts lead to increases in the number of programs, vocations, and areas of concern that were to be funded through the federal legislation. Datta (1979) points out that it was not until the passage of the Vocational Education Act of 1963, PL-88-210, that the perspectives for vocational education were broadened to include the development of human potential and long-term employability rather than the continuation of vocational education funding for the sole purpose of training people for specific, selected occupations.

In the last 75 years of vocational education funding and legislation, the two obvious groups that have had the major impact on the legislative process were industry and labor. While both industry and labor obviously have their own agendas, the one thing that they do have in common is that they view the function of vocational education from the perspective of the industrial model. Viewed in this context it is no wonder that questions related to the skills, knowledges, and attitudes obtained by the trainees and the costs, which tend to be higher than the costs of traditional programs, and benefits (or profits) of the programs, have been a major concern of vocational education legislation and evaluation. It is only within the last 15 years that there appears to have been a recognition of the need for vocational education to broaden its perspectives in terms of general human development. This change in emphasis can be seen in terms of the increased usage of the word "education" as opposed to the word "training," and even more recently, the shift from "vocational education" to that of "occupational education." Notwithstanding this

broadened outlook the historical context of vocational education and concerns for "accountability" require evaluation of vocational education programs to consider cost factors and the relationship of the programs to the world of work. This paper discusses these two major areas of concern to vocational education, that is, cost benefit and job and task analysis. The position taken here is that cost benefit analysis and job and task analysis should be viewed as approaches to evaluation or as components of total program evaluations. Depending on one's taxonomy of program evaluations, they may fit under a number of different categories (Webster & Stufflebeam, 1978). The first part of this paper deals with some of the issues and problems related to cost benefit analysis, the second deals with a description of the more recent approaches to job and task analysis.

In carrying out a cost benefit analysis it is necessary to decide on the costs and benefits to be included, the values of these costs and benefits, the rate at which they are to be discounted, and the relevant constraints on the system. Steiner & Smith (1979) point out that cost effectiveness is a method "...of identifying alternative solutions to a problem in terms of costs..." measured in dollars, while the effectiveness is measured in any number of terms provided that the term(s) selected is (are) applicable to the alternative(s). Cost benefit analysis usually compares the costs of a new program designed to solve an old problem with the costs of the old problem and its program, if any. Thus, the costs of the old problem become the benefits against which the new program's costs are to be compared.

Simply put, cost benefit analysis may be considered as the ratio of the output to the input with costs being considered inputs, and the bene-

fits being considered outputs. In terms of this ratio the value of one for the estimates of inputs and outputs would be obtained if there were an exact balance of the two economic values attached to these variables. If the value of the fraction is greater than one, the greater is the relative value of the benefits when compared to the costs. We can express the ratio of the present value of the benefits to the cost as

$$\sum_{t=1}^n \frac{B_t}{(1+i)^t} / \sum_{t=1}^n \frac{C_t}{(1+i)^t}$$

(Hu & Stromsdorfer, 1979; Fisher, Klees, Pacheco & Tobin, 1976) where t is the time period and i is the interest rate used for discounting.

Another approach to the use of cost and benefit data for program evaluation is that of the internal rate of return. In this approach the discounted costs are set equal to the discounted benefits and the equation is solved for the value of the internal rate of return, r . Internal rate of return (substitute r for i in the above expression) is then compared to the estimated rate of return for alternative programs. A third approach is the calculation of the present value of net benefits as the difference of the discounted value of the benefit and cost streams. Of the competing possible programs, the one with the largest net present value would be the one that should be selected for maximum payoff. The outcomes obtained through the use of one of these three alternatives may not necessarily give the same results as would be obtained if one of the other two approaches were used. The decision of which procedure to select is obviously a function of the values held by the evaluator and the program personnel, a problem that must be faced in evaluating any program regardless of the criteria used for examination of program effectiveness.

A useful dichotomy in dealing with some of the technical issues that must be

taken into account when carrying out cost benefit analyses for program evaluation is that of the distinction between social and private costs and benefits. Hu & Stromsdorfer (1979) list the following eight areas in terms of costs, the last four of which can also be considered as the basic private costs.

1. Current costs are also called operating costs and include such factors as teachers' salaries, heat, light, and other variable costs.
2. Capital costs of sites, buildings, and equipment.
3. Cost correction factors such as sales tax and property tax.
4. Costs from nonschool system support.
5. Earnings foregone while students are undergoing education.
6. Incidental costs to students associated with school attendance.
7. Job search costs.
8. On-the-job training costs.

Hu & Stromsdorfer (1979) describe some of the practical and theoretical issues involved in attempting to estimate the costs listed under each of these areas. Issues such as the difference between expenditures and costs and the allocation of joint costs and marginal costs are discussed. The benefits may also be considered in terms of the social and private gains to be made as a result of exposure to vocational education programs. Among the issues that can be included under the benefits side of the equation would be rates of economic growth or additional earnings for the individual, reduction in aberrant behavior as estimated by crime statistics, and an increase in "good citizenship." Here, too, there are problems related to appropriate estimates of the economic and non-economic benefits

to be attained by society and by the individual. Job satisfaction, for example, may be considered a benefit that would be an output resulting from vocational education programs as compared to improvement in general citizenship which could be a result of exposure to any education or social program. The study by Fisher et al. (1976) of the economic returns to BOCES secondary school occupational education investment, describe and discuss these issues and indicate procedures for and estimations of both costs and benefits through the use of multiple linear regression analysis. In addition, they employ dummy variables for factors which relate to these estimates such as marital status, sex, number of years of exposure to occupational education programs, etc.

Some work is currently underway in arriving at estimates of some of the variables described above. For example, an estimate of the "seriousness" of aberrant behavior was recently presented by Gray, Conover & Hennessey (1978) in their study of the cost effectiveness of residential community corrections compared to the usual approach of probation and institutionalization in dealing with adult and juvenile offenders. Hu & Stromsdorfer (1979) in their concluding remarks to their review of cost benefit analysis as it applies to occupational education make the following statement: "...in estimating the benefits and costs for a program based on actual data, economists often make several strong assumptions in order to adopt these data for the purpose of evaluation. Therefore, it is important for the decision maker to examine these assumptions and to question the judgments before making use of benefit-cost ratios... the benefit-cost ratio may be very misleading if it is calculated for the program as a whole. Policy makers are interested in the effectiveness of resources at the margin. The ratio for the program as a whole may provide misleading guidance for incremental decisions." In view of

their statement one cannot help but wonder as to the cost benefit ratio of doing cost benefit analyses.

Job and Task Analysis

Notwithstanding the expanded view of occupational education, most vocational programs, certainly at the secondary level, tend to be related to specific jobs and job titles. In view of this current state of affairs, it becomes crucial to investigate the relationship between the jobs for which the students are being prepared and the content (knowledges, skills and attitudes) that they are expected to master while they are in school. Job analysis is the technique that serves a dual function in this regard. On the one hand, job analysis helps to identify the components of a specific job and the importance of each of these components, and at the same time, job analysis can be used to evaluate components of instructional programs by investigating the relationship of these components to the jobs that exist in the world of work. Perhaps the relationship between job analysis and vocational education and its evaluation can best be seen by examining Wright's (1974) list of items that constitutes an appropriate job analysis.

1. A general description of the work to be done.
2. The organizational setting and relationships in which the work is accomplished.
3. The specific tasks which are to be carried out by the worker.
4. The equipment, tools and materials to be used.
5. The working conditions, including special hazards.
6. The qualifications required to learn or to perform these tasks stated in terms of knowledges, skills, abilities and personal characteristics (including physical).

7. The expected manner or quality of performance.
8. The process and expected outcomes of the performance. (Wright, 1974, p. 13.)

Most teachers would probably classify the items on this list as falling under the category of behavioral objectives and/or criterion-referenced measures. They would be right. Within this list there are a series of items that require closer analysis. However, let me take a moment to point to the key word in Item 3--the word "tasks." According to the Department of Labor's Handbook for Analyzing Jobs (1973, p. 3), "task" is defined as "...one or more elements and is one of the distinct activities that constitute logical and necessary steps in the performance of work by the worker. A task is created whenever human effort, physical or mental, is exerted to accomplish a specific purpose." It would appear that the crucial step in job analysis would be what has come to be known as task analysis.

Teryek (1979) in his review of job analysis methods and procedures indicates that there are six major procedures for gathering data that describe a job. The procedures generally used may be classified as:

- 1) interviews with workers or supervisors; 2) observations of work while it is in progress; 3) questionnaires completed by workers and supervisors; 4) completion of logs or diaries kept by employees over a period of time; 5) any combination of the above; and 6) a literature review of extant reports.

This list is equally valid for task analysis. He (Teryek, 1979) briefly sketches the different approaches to job analysis developed by and used in different government and private industry groups and points out that the crucial aspect of each job analysis ultimately depends on the task list that is used in describing the jobs to be performed.

Berger and Hawkins (1979) in describing the automated approach to occupational analysis that is currently in use by the United States Department of Defense (DOD), traced the history of the U.S. Army's approach to job and task analysis over the last 50 years. Not surprisingly, their data gathering methods were basically those described by Teryek (1979). Since 1973, DOD has used the Comprehensive Occupational Data Analysis Program (CODAP) system that was originally developed by the United States Air Force Human Resources Laboratory. The system consists of a set of more than 30 computer programs that organize, analyze, and report occupational information.

The basic approach in the system begins with the development of a task list questionnaire that is submitted to incumbents in the particular job for which the included tasks are supposedly descriptive. The incumbents complete the questionnaire on the basis of a relative time spent scale; that is, the incumbents who are involved in the specific tasks listed, indicate on a 1-7 scale the relative amount of time spent in doing the specific task, from (1) a very little to (7) very much. Figure 1

Insert Fig. 1 about here

shows a section from a task listing and the relative time scale for that particular section. These type of questionnaire data are analyzed in terms of the percent of members performing and the percent of time spent on the tasks. Campbell and Lindsey (1979), in describing Air Force performance ratings in relationship to their training programs, provide the following extract from an occupational survey report.

Insert Fig. 2 about here

Carperter, Georgia, and McFarland (1975) found that the relative time-spent scales produced more reliable information than frequency of performance or exact percent time scales as reported by Air Force personnel. The CODAP system provides a systematic approach to reporting and summarizing what people actually do on the job. It is also possible to request from the system special job descriptions as a function of the incumbent's backgrounds, the available equipment, reported job satisfaction, and/or differences in work performed by different groups of people. For example, work performed by men versus women, work performed by people at different pay levels, work as a function of background skill or education, etc. This type of approach obviously has a good deal to offer to non-military institutions involved in vocational education at both the secondary and postsecondary school levels. The civilian sector has, in fact, adapted many of the methods and procedures used by the DOD for development of the Vocational and Technical Education Consortium of the States (VTECS) procedures and materials.

A good deal of flexibility has been built into the CODAP system. For example, the group difference program, which permits one to investigate differences in task performance between any two previously defined groups according to any set of characteristics that are deemed to be worthy of investigation. The program can be modified so that only tasks which exceed a given critical value in terms of time spent or in terms of percent performing will be printed. It is also possible to use background data in the system as categorical variables for multiple linear regression type studies. Part of a CODAP report is shown in Figure 3.

Insert Fig. 3 about here

The first page of the printout shown in Figure 3 shows the breakdown of the job into its 18 component duties. The rest of the computerized report shows the tasks included under the job categorized according to the duties and listed in descending order of percent of members performing. In the DOD scheme of things, duties are an intermediate category between job (macro-description) and task (micro-description).

This brief description of job and task analysis, particularly the computer capabilities of CODAP and similar systems such as VTECS that are in the process of being developed, have rather direct implications for planning and evaluation. For example, task analysis may serve as a basis for curriculum planning and can lead to statements of behavioral objectives and criterion-referenced measures that assess student learning of the appropriate knowledges, skills, and attitudes (Campbell & Lindsey, 1979; Whitmore, 1979). Additionally, a CODAP-type system can help occupational educators derive listings of tasks that are required of employees at different levels. The listing can be tailored to include only those tasks which generally require a certain percent of worktime, say 30% or more, that employees spend at their job. It is also possible to use task lists to help develop job families that incorporate skills, knowledges, and attitudes that are normally embodied in different courses.

From the perspective of evaluating an ongoing program, task lists from existing data banks or developed as needed can serve as a major criterion for evaluating the relevance of the current programs. The skills and knowledges mastered by the students in the program can be matched to the current expectations of the job market as indicated by

the actual skills required of the people in the field. It is also possible to develop questionnaires for program graduates based on the task lists developed by CODAP-type systems to see whether or not the program graduates, at the time of their graduation, rate themselves as being capable on the tasks incorporated in the task lists. Follow-up studies are, another area in which these type of data would play a crucial role.

Task and job analysis descriptions could also serve as a basis for formative evaluation systems that might employ any one of a number of approaches. For example, a school system could easily employ a discrepancy evaluation model (Steinmetz, 1976) that has a set of goals drawn from existing job and task analyses. That is, school personnel could develop a set of priorities drawn from lists provided by a CODAP system. The tasks included in the training component of the program provided by the institution would be a function of the institution's past history, its capabilities, experiences, the job market for which it is preparing its students, the success it has had in placing its students, and continuing success in the job market of the program's graduates. The instructional systems development (ISD) approach based on task analysis that is used by the DOD is described by Campbell and Lindsey (1979) and Berger and Hawkins (1979).

Task Analysis and Cost Estimates

An important consequence of the task analysis approach for vocational education evaluation is that it provides outcome measures against which one can measure a planned or an ongoing program and also makes it possible to examine the outcome of the program from the perspective of cost benefit analysis. That is, a CODAP-type system contains data

useful in evaluating program outcomes and estimates of the costs and benefits of these outcomes. The brief discussion below is merely meant to be suggestive and hopefully will help to stimulate further developments and applications in this area.

Two concepts proposed for consideration that have been useful in arriving at estimates in cost effectiveness studies are the staging concept taken from medical care and the seriousness index (or what might be termed importance level) described in a recent study of residential community corrections (Gray, Conover, & Hennessey, 1978).

Gonnella, Louis & McCord (1976) defined staging in terms of medical care as a means of describing different levels of severity for specific medical problems. Typically, Stage 1 describes a disease with minimal severity. Stage 2 is descriptive of a disease with moderate severity, and Stage 3 represents disease with serious complications. It is of course possible to describe more than three stages, or sub-stages within each of the three main categories. Of course, description and determination of a specific stage does not indicate causes of the problem. Nor is there necessarily universal agreement and acceptance of the criteria. Conceivably, a different group of "experts" (medical societies, certification boards, etc.) might develop a different set of criteria. The staging concept, however, is clear. A recent study was reported of the cost of rheumatoid arthritis that used four stages to develop estimates of indirect and direct costs for Stage 3 severity arthritis patients (Meenan, Yelin, Heuke, Curtis, & Epstein, 1978). Using a CODAP-type system, one can develop stages for the skills, knowledge and attitudes required of graduates that would be analogous

to the staging concept. That is, one can list those items that are required of 75% of the personnel who are in the job market, those skills required by only 50%, and those skills required by only 25% of the personnel employed in the particular job. Institutions in the process of training people for these jobs would then be able to develop cost estimates for the training of the people in the three stages. The cost decisions would, in effect, be based on comparisons of different training programs that would yield the different levels of skills and knowledges of the trainees depending on whether they were in Stage 1, 2, or 3 programs. The usual problems of cost estimates would still have to be solved: short term vs. long term, expenditures vs. costs, allocation of joint costs, treatment of current and capital costs, etc. A major concern for the educational institution would be to develop a training program within its funding level that maximizes its students' outcomes without bankrupting itself. Staging and substaging based on task analysis would yield cost estimates useful in a rational decision process applied to these issues.

Another option might be to scale the tasks included in the task analysis according to some importance weighting scheme, similar to the severity index developed for the residential community corrections study. In this system, experts would be asked to rate the different tasks within a given percent of members performing scale, or a percent of time spent performing scale. Values could then be scaled and estimates of the costs and benefits for each of the specific tasks could then be included in the cost benefit analysis. For example, all those tasks at the 50% members performing level could be scaled in terms of perceived importance, and cost allocations could be scaled accordingly.

For example, Berger & Hawkins (1979) describe the use of the CODAP system in relation to its cost effectiveness as a result of varying the scale values that relate to decisions about the training to be included and the purposes for which it should be accomplished.

Both of these approaches have obvious ramifications for state or district allocation of funds for occupational education programs and the expected levels of sophistication in each of these programs. These approaches would not replace the current political and value judgments that are inherent in the ongoing programs in the school systems within any region or state. Rather, it would make more explicit what those value systems are, and ultimately permit a closer look at the costs and benefits of those value systems.

Notwithstanding the need for cost benefit analysis and the possibilities of fuller descriptions of what should be included in vocational education programs based on scales of actual performance and time spent, Hu & Stromsdorfer (1979) concluded their review of cost benefit analysis in vocational education as follows:

Future studies of vocational education should be focused not only on the economic data but also on the non-economic benefits and cost of vocational education, in this respect, economists, educators and psychologists should work together to improve the techniques of benefit cost analysis and vocational education.

TASK SECTION

IF YOU DON'T DO IT -- DON'T MARK IT!

		VERY LITTLE	BELOW AVERAGE	SLIGHTLY BELOW AVERAGE	AVERAGE	SLIGHTLY ABOVE AVERAGE	ABOVE AVERAGE	VERY MUCH	
Times Spent on Job									
8.									
B. PERFORM LENS SURFACING CALCULATIONS/INSPECTION DUTIES (CONT)	B								
☐ 21. RECORD AMOUNT AND BASE DIRECTION OF PRESCRIBED PRISM	21	☐	☐	☐	☐	☐	☐	☐	WED/3/12/82/
☐ 22. RECORD IDENTIFICATION DATA	22	☐	☐	☐	☐	☐	☐	☐	
☐ 23. RECORD SPECIAL PROCEDURES	23	☐	☐	☐	☐	☐	☐	☐	
☐ 24. VERIFY SEGMENT INSET	24	☐	☐	☐	☐	☐	☐	☐	
☐ 25. RECORD SEGMENT INSET	25	☐	☐	☐	☐	☐	☐	☐	
☐ 26. INSPECT LENSES FOR SURFACE DEFECTS USING INSPECTION LAMP	26	☐	☐	☐	☐	☐	☐	☐	
☐ 27. PLACE SPHERE LAPS IN APPROPRIATE STORAGE RACK	27	☐	☐	☐	☐	☐	☐	☐	
☐ 28. PLACE CYLINDER LAPS IN APPROPRIATE STORAGE RACKS	28	☐	☐	☐	☐	☐	☐	☐	
☐ 29. INSP SURFACED LENSES FOR POWER ACCURACY USING LENSOMETER	29	☐	☐	☐	☐	☐	☐	☐	
☐ 30. PREPARE SURFACE WORKSHEET FOR PLASTIC LENS BLANKS	30	☐	☐	☐	☐	☐	☐	☐	
C. PERFORM LENS SURFACING DUTIES	C								0171
☐ 1. LAYOUT SEMI-FINISHED LENS BLANKS FOR SURFACING	1	☐	☐	☐	☐	☐	☐	☐	
☐ 2. APPLY LENS COATING FOR BLOCKING	2	☐	☐	☐	☐	☐	☐	☐	
☐ 3. BLOCK GLASS/PLASTIC LENS BLANKS USING ALLOY BLOCKING UNIT	3	☐	☐	☐	☐	☐	☐	☐	
☐ 4. RECLAIM ALLOY FROM BLOCKING BODIES USING RECLAIM TANK	4	☐	☐	☐	☐	☐	☐	☐	
☐ 5. CLEAN BLOCKING BODIES	5	☐	☐	☐	☐	☐	☐	☐	
☐ 6. REDUCE DIAMETER USING CHIPPING PLIERS	6	☐	☐	☐	☐	☐	☐	☐	
☐ 7. REDUCE DIAMETER USING LENS CRIBBER	7	☐	☐	☐	☐	☐	☐	☐	
☐ 8. SELECT APPROPRIATE SPHERE LAP	8	☐	☐	☐	☐	☐	☐	☐	
☐ 9. SELECT APPROPRIATE CYLINDER LAP	9	☐	☐	☐	☐	☐	☐	☐	
☐ 10. CLEAN SPHERE LAPS	10	☐	☐	☐	☐	☐	☐	☐	
☐ 11. CLEAN CYLINDER LAPS	11	☐	☐	☐	☐	☐	☐	☐	
☐ 12. CHECK SPHERE LAPS FOR ACCURACY USING GAUGE SET	12	☐	☐	☐	☐	☐	☐	☐	
☐ 13. CHECK CYLINDER LAPS FOR ACCURACY USING GAUGE SET	13	☐	☐	☐	☐	☐	☐	☐	
☐ 14. TRUE SPHERE LAPS USING TRUING DISC AND HAND PAN	14	☐	☐	☐	☐	☐	☐	☐	

Figure 1. Task section page from 1972 U.S. Army occupational survey questionnaire, (Berger and Hawkins, 1979).

Description of current job in aircraft maintenance career ladder based on background variables. Shows percent members performing and percent time spent on tasks. Tasks are sorted high to low percent time spent by group members.

Task job description, Cases=9233, Tasks=362, Duties=14, MBRS=9232
All airmen in Crr Field DAFSC 431XIX/91 TOTAL SAMPLE

Cumulative sum of average percent time spent by all members.....					
Average percent time spent by all members					
Average percent time spent by members performing					
Percent of members performing.....					
D-Tsk	Duty/Task Title				
F 16	Inspect Aircraft for Structural Damage	72.89	1.60	1.17	1.17
F 17	Inspect Airframe and Components	70.82	1.60	1.13	2.30
M 2	Defuel or Refuel Aircraft	68.08	1.64	1.12	3.41
G 9	Launch and Recover Aircraft	62.31	1.66	1.03	7.69
1 8	Inspect and Service Liquid Oxygen Systems	42.67	1.25	0.53	42.73

Task job description, Cases=9233, Tasks=362, Duties=14, MBRS=174
DAFSC 43131A App Reciprocating Engine Aircraft

1 8	Inspect and Service Liquid Oxygen Systems	6.32	2.24	0.14	91.91
-----	---	------	------	------	-------

Task job description, Cases=9233, Tasks=362, Duties=14, MBRS=174
DAFSC 43131E App Reciprocating Engine Aircraft

1 8	Inspect and Service Liquid Oxygen Systems	37.58	1.87	0.70	55.98
-----	---	-------	------	------	-------

Task job description, Cases=9233, Tasks=362, Duties=14, MBRS=1607
DAFSC 43151E Jet Aircraft Over Two Engines Specialist

1 8	Inspect and Service Liquid Oxygen Systems	47.92	1.22	0.59	47.44
-----	---	-------	------	------	-------

Task job description, Cases =9233, Tasks=362, Duties=14, MBRS=672
DAFSC 43171E Jet Aircraft Over Two Engines Technician

1 8	Inspect and Service Liquid Oxygen Systems	54.17	0.85	0.46	51.79
-----	---	-------	------	------	-------

3-, 5-, and 7-skill levels

Figure 2. Extracts from Occupational Survey Report, (Campbell and Lindsey, 1979).

DUTY JOB DESCRIPTION	CASES 900	TASKS 633	DUTIES 18	HOURS 574
CUMULATIVE SUM OF AVERAGE PERCENT TIME SPENT BY ALL MEMBERS.....				
AVERAGE PERCENT TIME SPENT BY ALL MEMBERS.....				
AVERAGE PERCENT TIME SPENT BY MEMBERS PERFORMING.....				
PERCENT OF MEMBERS PERFORMING.....				
D-TSK	DUTY/TASK TITLE			
G	PERFORM POWER TRAIN COMPONENT MAINTENANCE	94.26	11.09	10.46
F	PERFORM GASOLINE/DIESEL ENGINE ELECTRICAL SYSTEM MAINTENANCE	94.08	21.77	20.98
D	PERFORM GASOLINE AND DIESEL FUEL SYSTEM MAINTENANCE	93.73	11.54	10.83
C	PERFORM GASOLINE AND DIESEL ENGINE MAINTENANCE	93.56	7.13	6.67
E	PERFORM GASOLINE/DIESEL ENGINE COOLING SYSTEM MAINTENANCE	93.03	6.90	6.49
H	PERFORM BRAKE MAINTENANCE	92.94	10.79	10.02
J	PERFORM BODY/CAB/FRAME/TOWING ATTACHMENT MAINTENANCE	87.11	4.54	3.97
N	PERFORM MILITARY DUTIES	83.46	4.73	3.95
H	PERFORM MAINTENANCE ADMINISTRATION	79.79	8.09	6.45
P	PERFORM WHEELED VEHICLE OPERATOR DUTIES	78.40	7.48	6.87
I	PERFORM STEERING SYSTEM MAINTENANCE	76.48	3.70	2.83
K	PERFORM SPRING AND SHOCK ABSORBER MAINTENANCE	74.39	2.73	2.03
A	PERFORM WHEELED VEHICLE MECHANIC SUPERVISION	56.79	7.74	4.39
O	PERFORM TIRE REPAIR DUTIES	55.92	2.67	1.99
L	MAINTAIN WHEELED VEHICLE WINCH, POWER TAKEOFF AND HOIST	54.70	2.18	1.19
W	PERFORM SHOP MANAGEMENT DUTIES	42.68	3.70	1.58
N	PERFORM WRECKER OPERATOR/RECOVERY OPERATION DUTIES	38.86	4.61	1.79
U	PERFORM GENERATOR SET OPERATOR DUTIES	14.29	2.88	.91

Figure 3. Results of Military Occupational Survey 63B Wheel Vehicle Mechanic, (Abramson, 1978).

TASK JOB DESCRIPTION	CASES 900	TASKS 633	DUTIES 18	HOURS 574					
CUMULATIVE SUM OF AVERAGE PERCENT TIME SPENT BY ALL MEMBERS.....									TASK
AVERAGE PERCENT TIME SPENT BY ALL MEMBERS.....									SEC
AVERAGE PERCENT TIME SPENT BY MEMBERS PERFORMING.....									NO
PERCENT OF MEMBERS PERFORMING.....									
D-TSK	DUTY/TASK TITLE								
G 10	ADJUST CLUTCH LINKAGE	84.49	.84	.73	.73				
N 16	BLEED BRAKE SYSTEM	84.15	.82	.69	1.42				
E 23	ADJUST FAN BELTS	83.45	.81	.68	2.10				
H 8	ADJUST HAND PARKING BRAKE	82.58	.65	.71	2.81				
E 14	REPLACE RADIATOR HOSES	82.40	.66	.54	3.35				5
E 22	REPLACE FAN BELTS	81.88	.72	.59	3.94				
F 40	TEST BATTERIES	81.53	.79	.64	4.58				
G 48	SERVICE WHEEL BEARING	80.84	.89	.72	5.30				
F 51	REPLACE HEAD AND TAIL LIGHTS	80.49	.68	.65	5.85				
F 92	REPLACE SPARK PLUGS	80.14	.64	.61	6.36				10
F 50	TEST HEAD AND TAIL LIGHTS	79.79	.81	.65	7.01				
G 50	REPLACE WHEEL BEARING	79.62	.78	.62	7.63				
F 61	REPLACE BATTERIES	79.44	.81	.64	8.27				
C 23	REPLACE ENGINE OIL FILTER ELEMENT	77.87	.86	.67	9.94				
G 51	REPLACE WHEEL SEALS	77.35	.78	.61	9.54				15
F 18	ADJUST ALTERNATOR BELT	75.61	.64	.49	10.03				
F 40	SERVICE SPARK PLUGS	75.26	.62	.46	10.49				
F 62	REPLACE BATTERY CABLES	74.91	.66	.49	10.99				
G 46	ADJUST SERVICE BRAKE SHOES	74.74	.69	.52	11.50				
H 7	INSPECT BRAKE SYSTEMS	74.74	.75	.56	12.07				20
F 14	REPLACE ALTERNATOR	74.56	.60	.45	12.51				
F 17	REPLACE GENERATOR	74.56	.59	.44	12.95				
C 1	TROUBLESHOOT 1/4 TON SERIES GASOLINE ENGINE MALFUNCTIONS	74.39	.73	.54	13.50				
G 49	ADJUST WHEEL BEARING	74.39	.63	.62	14.11				
H 11	ADJUST HAND BRAKE SHOE	74.39	.71	.63	14.64				25
E 13	REPLACE RADIATOR	74.22	.58	.43	15.07				
H 9	REPLACE HAND PARKING BRAKE	73.69	.49	.51	15.58				
F 41	ADJUST SPARK PLUGS	73.52	.62	.45	16.03				
F 39	ADJUST POINT SET	73.34	.58	.42	16.46				
H 13	REPLACE MASTER CYLINDER	73.00	.61	.45	16.91				30
H 15	REPLACE WHEEL CYLINDER	72.65	.63	.46	17.36				
E 12	INSPECT ENGINE COOLING SYSTEMS	72.30	.69	.50	17.86				
F 19	REPLACE ALTERNATOR BELT	72.30	.58	.42	18.28				
H 12	REPLACE HAND BRAKE SHOE	72.13	.67	.49	18.77				
F 30	REPLACE INSTRUMENT GAUGES	71.95	.65	.47	19.24				35
H 3	TROUBLESHOOT 4 1/2 TON SERIES BRAKES FOR MALFUNCTIONS	71.95	.62	.45	19.69				

Figure 3. (Continued)

References

- Abramson, T. Instructional support system - occupational education II: ISSOE automotive mechanics content validation. Institute for Research and Development in Occupational Education, City University of New York, CASE Report #31-78, 1978.
- Berger, B.M. & Hawkins, H.H. An automated approach to occupational analysis. In T. Abramson, C.K. Tittle, & L. Cohen (Eds.), Handbook of Vocational Education Evaluation. Beverly Hills, Cal.: Sage Publications, 1979.
- Campbell, D.F. & Lindsey, H.C. Air Force performance ratings: Assessment methods for occupational education and evaluation. In T. Abramson, C.K. Tittle, & L. Cohen (Eds.), Handbook of Vocational Education Evaluation. Beverly Hills, Cal.: Sage Publications, 1979.
- Carpenter, J.B., Georgia, M.J. & McFarland, B.P. Comparative analysis of the relative validity for subjective time rating scales (AFHRL-TR-75-63). Lackland Air Force Base, Tex.: Human Resources Laboratory, December 1975.
- Datta, L.E. Better luck this time: From federal legislation to practice in evaluating vocational education. In T. Abramson, C.K. Tittle, & L. Cohen (Eds.), Handbook of Vocational Education Evaluation. Beverly Hills, Cal.: Sage Publications, 1979.
- Fisher, D., Klees, S., Pachico, D. & Tobin, D. The economic returns to BOCES secondary school occupational education investment. Ithaca, New York: Cornell Institute for Research and Development in Occupational Education, Cornell University, Report #76-2, February 1976.
- Gallinelli, J. The development and role of vocational education programs at the secondary level. In T. Abramson, C.K. Tittle, & L. Cohen (Eds.), Handbook of Vocational Education Evaluation. Beverly Hills, Cal.: Sage Publications, 1979.
- Gonnella, J.S., Louis, L.Z. & McCord, J.J. The staging concept--an approach to the assessment of an outcome of ambulatory care. Medical Care, 1976, 14, 13-21.
- Gray, C.M., Conover, C.J. & Hennessey, T.M. Cost effectiveness of residential community corrections: An analytical prototype. Evaluation Quarterly, 1978, 2, 375-399.
- Handbook for Analyzing Jobs. Washington, D.C.: Manpower Administration, U.S. Department of Labor, 1972.
- Hu, T. & Stromsdorfer, E.W. Cost-benefit analysis of vocational education. In T. Abramson, C.K. Tittle, & L. Cohen (Eds.), Handbook of Vocational Education Evaluation. Beverly Hills, Cal.: Sage Publications, 1979.

- Meenan, R.F., Yelin, E.H., Henke, C.J., Curtis, D.L. & Epstein, W.V.
The costs of rheumatoid arthritis: A patient oriented study of
chronic disease costs. Arthritis and Rheumatism, 1978, 21, 827-833.
- Steiner, K.C. & Smith, H.A. Application of cost-benefit analysis to a
PKU screening program. In V. Mahajan & C.C. Pegels (Eds.), Systems
Analysis in Health Care. New York: Praeger, 1979.
- Steinmetz, A. The discrepancy evaluation evaluation model. Measurement
in Education, 1976, 7, 1-5.
- Tervak, C.J. An overview of job analysis: Methods, procedures, and use
in vocational education. In T. Abramson, C.K. Tittle, & L. Cohen
(Eds.), Handbook of Vocational Education Evaluation. Beverly Hills,
Cal.: Sage Publications, 1979.
- Webster, W.J. & Stufflebeam, D.L. The state of theory and practice in
educational evaluation in large urban school districts. Address
presented at the annual meeting of the AERA, Toronto, 1978.
- Whitmore, P.G. Content validity of behavioral objectives. In T. Abramson,
C.K. Tittle, & L. Cohen (Eds.), Handbook of Vocational Education
Evaluation. Beverly Hills, Cal.: Sage Publications, 1979.
- Wright, G.H. Public sector employment selection. Chicago, Illinois:
International Personnel Management Association, 1974.